

# Clean Indoor Air

*Health Objectives for the Year 2010: Prohibit smoking in most public buildings, unless it is within an enclosed, separately ventilated area. Manage public buildings, such as schools, office buildings, and government offices, for good indoor air quality. Assure that new buildings meet American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) standards for ventilation.*

## Health Implications

Poor indoor air quality is an important environmental health concern because the average person spends more than 90% of his or her time indoors. Indoor air quality studies have found recurring correlations between indoor air pollution and human illness. Common symptoms associated with contaminated indoor air include headaches, eye irritation, respiratory irritation, and gastrointestinal distress. Some indoor air pollutants have been linked directly to fatalities, such as carbon monoxide or *Stachybotrus* toxin. Indoor air pollution can trigger asthma attacks. Causes of indoor air pollution include lack of ventilation, improper venting of combustion exhaust, environmental tobacco smoke, off-gassing of building materials, production of paper or copier particulates, growth of mold and mildew, and improper use of hazardous materials. Poor indoor air quality has a huge impact in terms of productivity and lost work time.

Currently, there are no federal or local regulations that require indoor air

quality to be protective of human health in public buildings. The Nebraska Clean Indoor Air Act (NCIAA) requires designation of smoking and nonsmoking areas of public buildings, but it does not broadly protect indoor air quality. Consequently, education and technical assistance are the primary tools used by LLCHD to reduce risks from indoor air pollution. The program is based on hazard identification and providing technical assistance to home, building, and business owners on how to reduce the health risk from exposure to indoor air pollution. This may be accomplished through over-the-phone consultation, distribution of educational materials, or on-site investigation. A typical on-site investigation includes evaluation of possible sources of pollution, a survey of occupants to identify patterns of illness, and environmental monitoring. There are no health-based, chemical-specific standards for indoor air quality. However, ambient screening for temperature, humidity, formaldehyde, volatile organic compounds, carbon dioxide, carbon

**Table 1. Clean Indoor Air Indicators**

	Lancaster Recent	Lancaster Objective 2010	Nebraska Recent	Nebraska Objective 2010	National Recent	National Objective 2005
Percent of public buildings that are smoke free	-- <sup>1</sup>	100.0	--	--	--	--
Percent of schools and child care centers that are implementing an indoor air quality management plan	1.7 <sup>2</sup>	15.0	--	--	--	15.0 <sup>3</sup>
Percent of office buildings that are implementing an indoor air quality management plan	-- <sup>4</sup>	10.0	--	--	--	5.0 <sup>3</sup>
Percent of government offices that are implementing an indoor air quality management plan	12.5 <sup>5</sup>	25.0	--	--	--	--
Percent of new buildings that meet American Society of Heating, Refrigeration, and Air-Conditioning Engineers standards for ventilation	-- <sup>4</sup>	100.0	--	--	--	--

monoxide, and hydrogen sulfide and testing of air handling units for air velocity and flow rates can provide information on the healthfulness of the indoor air. These environmental tests,

along with visual identification of indoor air pollution sources, form the basis of risk-reduction recommendations provided to home, building and business owners.

## Current Status and Trends

Between 100 and 200 on-site case investigations of indoor air pollution are conducted annually in Lincoln–Lancaster County. A review of these investigations reveal that some conditions and situations are common to indoor air quality problems.

Improperly designed, operated, or maintained heating, ventilating, and air conditioning systems are the source of about 50% of indoor air quality problems. Specific problems include poorly maintained equipment contaminated with standing water or dirt, deteriorating mechanical parts, poor air filtration, lack of fresh air, deteriorated fiberglass-lined ductwork, insect and animal infestation, poor design, and improper location of fresh air intakes near outdoor air contamination sources.

Remodeling activities cause about 30% of indoor air quality problems. Problems include use of products containing volatile organic chemicals without regard to label restrictions; lack of adequate ventilation; escape of dust and chemical vapors from remodeling area into adjacent occupied areas of buildings, resulting in exposure to the public and building occupants; and ongoing emissions of chemical vapors from installed materials after completion of remodeling projects.

Miscellaneous problems cause about 20% of indoor air quality problems. These include smoking in public places, multi-family dwellings, and dormitories; exposures resulting from home hobbies; contamination of the general air in multi-use office buildings by a single tenant's activities; and microbiological contamination due to flooding, water

leaks, condensation, groundwater, and other water sources. Recently, a large number of investigations have been made for mercury vapor caused by broken thermometers and other metallic mercury sources.

### Pollutants of Special Concern

Environmental tobacco smoke (ETS) is an irritant, an asthma trigger, and increases the risk of lung cancer in nonsmokers. Although the Nebraska Clean Indoor Air Act promotes the use of designated smoking areas, it does not effectively protect the public from ETS exposure in restaurants and public buildings.

Carbon monoxide (CO) is a potentially lethal indoor air pollutant. Exposure can also cause significant nonlethal illness. With the increasing use of CO detectors, calls regarding this pollutant increased, especially from people who assume their new detector is malfunctioning when it begins sounding soon after it is installed. Resolution of the problem typically involves Peoples Natural Gas, whose staff can examine furnaces, water heaters, and stoves to determine if any defects are causing a buildup of CO. The Indoor Air Quality Program's role is in educating the public on how CO is formed and how its buildup can be prevented. Second, the program provides technical assistance to the Lincoln Fire Department on policies related to handling CO detector alarm calls.

Ozone from ozone-generating "air purifiers" or "air cleaners" has become a pollutant of concern in recent years. Ironically, businesses or homeowners purchase these devices out of concern

for improving indoor air quality. In reality, ozone is a potential eye and respiratory system irritant that has some effectiveness in destroying odor-causing organics but only at concentrations so high they cannot be tolerated by humans. Although some machines have the capability of limiting ozone output, LLCHD continues to follow EPA's lead and advocate for the traditional IAQ improvement strategies of source reduction, filtration, and proper ventilation.

Mercury vapor from broken thermometers, thermostats, fluorescent light bulbs, and blood pressure cuffs and other sources of metallic mercury is a hazard of which the public has become more aware in the last two years. As a result, a large number of calls have resulted in investigations and assisted cleanups. Mercury poisoning can cause emotional disturbances, fatigue, kidney damage, and other serious health problems. As with other pollutants, children are particularly susceptible to exposure and to central nervous system effects caused by poisoning. LLCHD provides assistance in assessing spills and cleaning up contaminated surfaces in order to reduce health risk from the vapor. LLCHD actively promotes the use of nonmercury thermometers and other devices.

Radon is categorized by the EPA as one of approximately 20 known human carcinogens. It is also considered a distant second to cigarette smoking as a leading preventable cause of lung cancer. The risk of lung cancer increases with exposure to increasing levels of radon in the indoor environment. A combination of cigarette smoking and long-term exposure to increased levels of radon increases individual risk exponentially. The LLCHD provides long-term (one-year) test devices to the general public, businesses, schools, and govern-

ment agencies at cost. The test devices include analysis by a certified laboratory and a report issued by LLCHD with interpretation of the results and recommendations for hazard mitigation. During the last year, 19 test devices were sold and 12 reports issued. Sixteen of the 19 tests revealed results above the EPA action level of 4 pic/L. Mitigation recommendations were provided to the home and building owners to assist them in reducing the risk to building occupants. LLCHD staff members are in the process of following up with the home and building owners to determine if mitigation occurred. Constructing buildings to be radon resistant is a known technology which is not in wide spread use in Lincoln-Lancaster County.

Indoor air is an important aspect of keeping children's environments healthy. As national focus turns to reducing the incidence of asthma in children, identifying and eliminating asthma triggers in the indoor environment and reducing other indoor air pollution sources is becoming important. Over the past two years, LLCHD promoted the adoption of EPA's "Tools for Schools" in Lincoln-Lancaster County schools and childcare centers. This tool allows a school to assess current indoor air quality problems and establish a plan to manage the school building for good indoor air quality to prevent future problems. Currently, only two schools have completed the process nevertheless, LLCHD continues to promote the use of "Tools for Schools."

LLCHD has also been promoting the development of indoor air quality management plans for public buildings. This is being piloted with several City-County government buildings managed by the Building Commission using EPA's "Building Air Quality Management" guide.

## Health Disparities

Indoor air quality problems have been observed in the spectrum of building from old deteriorated homes to new expensive homes. However, solving these problems is related to having the property control and resources to effect repairs or improvements. As a result,

children in poverty, low-income persons, and minority populations may be disproportionately affected by indoor air quality problems because there is a higher proportion of renters among these groups.

## Public Health Infrastructure

- ♦ As mentioned, no effective regulatory structure exists to assure that Lincoln–Lancaster County residents have clean indoor air. The Nebraska Clean Indoor Air Act needs to be made more enforceable and perhaps broadened to address issues other than just ETS. Another mechanism that would provide some assurance would be a local ordinance limiting ETS and other indoor air quality issues.

Several objectives relate to increasing the number of buildings that are smoke-free, have IAQ management plans or are designed to meet ASHRAE ventilation standards. However, the baseline number of buildings that meet these objectives is unknown. An important infrastructure need is to identify the baseline against which progress can be measured.

## Recommendations

- ♦ Continue to promote practices that result in clean indoor air: indoor pollution source elimination, appropriate ventilation, and good operation and maintenance of ventilation systems. This promotion occurs through education and on-site technical assistance to individual homeowners and building managers; educational outreach to builders,

HVAC contractors and architects on indoor air quality issues and educational outreach and technical assistance to schools, daycare centers, and building managers on developing and implementing indoor air quality management plans.

- ♦ Advocate for prohibition of smoking indoors through strengthening the NCIAA or passing a local ordinance.

Notes

Related discussion or indicators are located in the chapters on *Toxic and Hazardous Materials* and *Tobacco Use*.

- Currently no data source.
- 1. Currently no data source. Measurement approach should be developed which surveys and includes the range of public and business spaces open to the public.
- 2. Lincoln–Lancaster County Health Department, Indoor Air Program, Tools for Schools assessments.
- 3. United States Environmental Protection Agency, *EPA Strategic Plan*, September 1997.
- 4. Currently no data source. Strategies to measure these indicators are in development by the Lincoln–Lancaster County Health Department, Indoor Air Program.
- 5. Lincoln–Lancaster County Health Department, Indoor Air Program.